

Synthesis of lithium titanate ($\text{Li}_4\text{Ti}_5\text{O}_{12}$) through hydrothermal process by using lithium hydroxide (lioh) and titanium dioxide (TiO_2) xerogel

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Abstrak

Lithium Titanate ($\text{Li}_4\text{Ti}_5\text{O}_{12}$) or (LTO) has a potential as an anode material for a high performance lithium ion battery. In this work, LTO was synthesized by a hydrothermal method using Titanium Dioxide (TiO_2) xerogel prepared by a sol-gel method and Lithium Hydroxide (LiOH). The sol-gel process was used to synthesize TiO_2 xerogel from a titanium tetra-n-butoxide/ $\text{Ti}(\text{OC}_4\text{H}_9)_4$ precursor. An anatase polymorph was obtained by calcining the TiO_2 xerogel at a low temperature, i.e.: 300°C and then the hydrothermal reaction was undertaken with 5M LiOH aqueous solution in a hydrothermal process at 135°C for 15 hours to form $\text{Li}_4\text{Ti}_5\text{O}_{12}$. The sintering process was conducted at a temperature range varying from 550°C , 650°C , and 750°C , respectively to determine the optimum characteristics of $\text{Li}_4\text{Ti}_5\text{O}_{12}$. The characterization was based on Scanning Thermal Analysis (STA), X-ray Powder Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), Fourier Transform Infrared spectroscopy (FTIR), and Brunauer-Emmett-Teller (BET) testing results. The highest intensity of XRD peaks and FTIR spectra of the LTO were found at the highest sintering temperature (750°C). As a trade-off, however, the obtained LTO/ $\text{Li}_4\text{Ti}_5\text{O}_{12}$ possesses the smallest BET surface area ($< 0.001 \text{ m}^2/\text{g}$) with the highest crystallite size (56.45 nm).